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UNDERSTANDING MAKE-UP REMOVAL USING FACIAL- AND FINGER-TRACKING

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1 INTRODUCTION

Make-up removal is part of the daily routine for cosmetics consumers, but is often seen as a dreaded chore. Due to this consumer tension an increased importance has been placed on formulating more efficient makeup remover products. This creates a critical need to be able to evaluate and differentiate makeup remover efficiency. However, the make-up cleansing process has many variables that confound our ability to reliably quantify the experience. These sources of variability include the consumer dexterity, the type of makeup being removed, the type of cleanser liquid and the type of cleansing substrate. We have created a video-based system, based on facial and object tracking, to decompose the makeup-removal experience into a small set of objective metrics, which can then be used to predict the consumer's subjective perception of their removal experience.

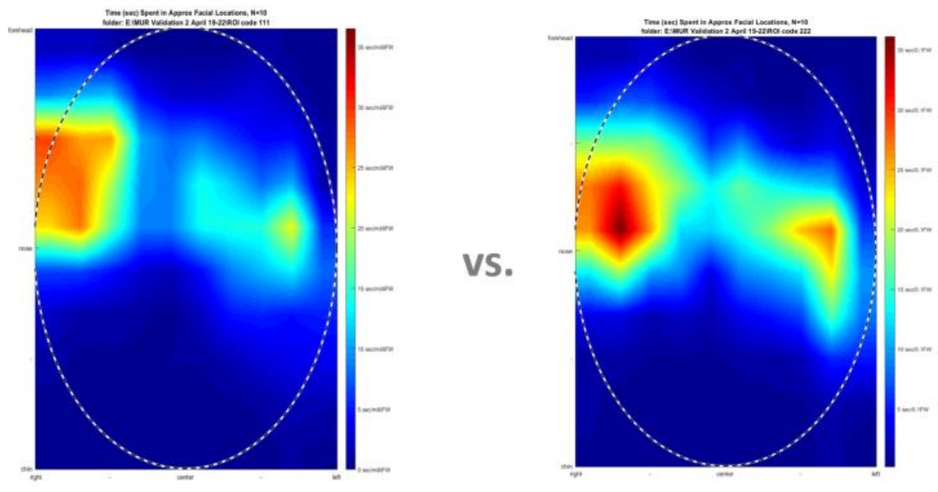

Fig-5. Heat-maps (left, oil-based and right, water-based) showing our ability to visualize where (N=10) women spent time on their face approximately. Hotter colors indicate more time cleansing in that area.

2 MATERIALS AND METHODS

Video acquisition system requires a camera, such as that on a smartphone, and a room, large enough to contain a human, so that the human's face is visible on the screen during self-video-capture. The room has to be sufficiently illuminated to minimize camera noise, enable good auto-focusing, and avoid high-contrast shadows on the face. Finally, the human wears a glove or marking on their fingers that is of a color that can be easily detected through the video-analysis.

Fig -1. Video capture system with finger markers, basic lighting, with HD video recording system.

After finger-marking is secured, the subject removes their makeup as they normally would. All videos are then processed through an open-source Python library (e.g. dlib or OpenPose [1]) which outputs the location, time-points and confidence of 70 facial markers into a readable CSV file. Next, the video is processed by our own, L'Oreal proprietary algorithm that combines face-tracking data with finger-tracking data, renormalizes the data, and produce valuable metrics, namely: Total Time, Time-On-Skin, Distance Travelled on Skin, Speed of Movements on Skin.

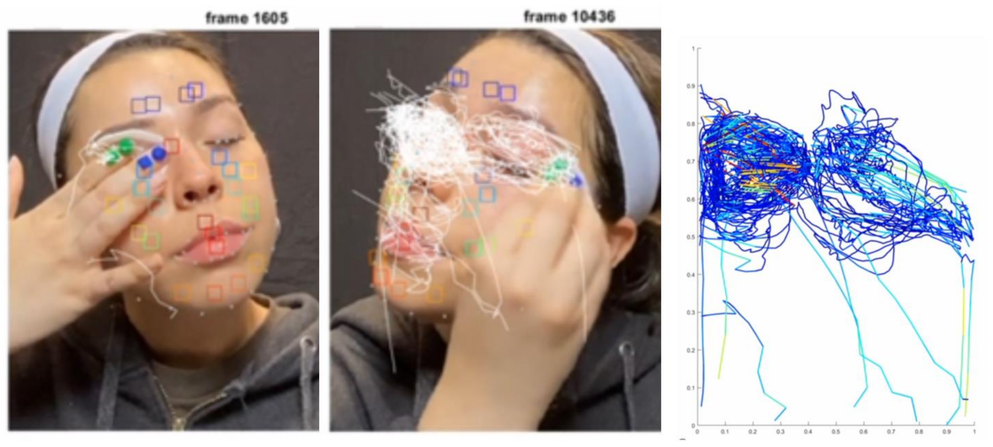

Fig -2. Combining facial tracking (white points) with object tracking (white lines) allows measuring of the trajectories of a person removing makeup. These trajectories are rescaled (rightmost image) to the width and height of the face so that we can clearly observe she is removing mascara.

3 RESULTS & DISCUSSION

Our pilot study (Fig-3, N=10 women tested 2 cleansers each) revealed statistically significant differences between an oil-based and a water-based cleanser while removing mascara (Fig-3). The two metrics – Total Time and Time on Skin – both showed statistical differences between the products, in a paired analysis. In fact, 90% of the models spent more Total Time removing the mascara with the water-based cleanser; while 80% of the models spent more Time-on-Skin removing the water-based cleanser. Metrics, Distance Travelled on Skin and the Speed of Movements on Skin, did not show statistical differences between the products.

Interestingly, the individual metrics of each model suggests that each woman has a characteristic cleansing routine; one woman spent 175 to 280 seconds cleansing their eyes, while another woman spent less than 50 seconds for both cleansing products. It may be possible that there will be a tension between the performance metrics of a cleanser and the cleansing habits of a person.

Fig-3. A N=10 women-study, testing a water-based (orange) and oil-based cleanser (blue). The four metrics are Total Time, Time-On-Skin, Distance Travelled On Skin and Speed of Movements on Skin. Only the two time-based metrics showed differentiation between the oil-based cleanser and water-based cleanser.

Finally, our objective data correlates very well to the survey each model answered during their study visit (Fig-4). Two-thirds of models stated that the water-based cleanser took longer than the oil-based cleanser, and the oil-based cleanser was a "preferred experience." We are still investigating whether time is the only factor to the cleansing experience

Fig-4. After cleansing, each woman (N=10) evaluated their mascara-removal experience using an unlimited amount of cotton pads and makeup remover.

The novelty of our research is the full automation of natural gesture analysis – no person is needed to measure the time – and the fact that we can analyze the movements of cleansing relative to a human face. Fig-5 illustrates the power of this data acquisition: we can observe areas where the average (N=10, right-hand-dominant) woman spent the most time on their face – indicating that the natural human gesture is to spend more time on their dominant side of their face! We continue to build new metrics to dig deeper into the experience of cleansing.

4 CONCLUSIONS

The makeup-cleansing experience is a very personal, nuanced routine that has evaded cosmetic researchers searching for objective and relevant metrics. Our facial- and object-tracking-based system can measure objective attributes, without the need for supervision, and using minimal and accessible equipment. This promises a large-scale understanding of make-up removal experience and quantification of remover efficacy, especially at a time where people are hyper-aware of cleanliness and spending more time at home.

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References:
Open Pose / https://github.com/CMU-Perceptual-Computing-Lab/openpose

Aknowlegements :
Margarita YATSKAYER; Jessica ARAGONA; Maureen PLATT; Joe BADAMI; L'Oreal Scientific Communications